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Petroleum Engineer® INTERNATIONAL

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ENHANCED RECOVERY

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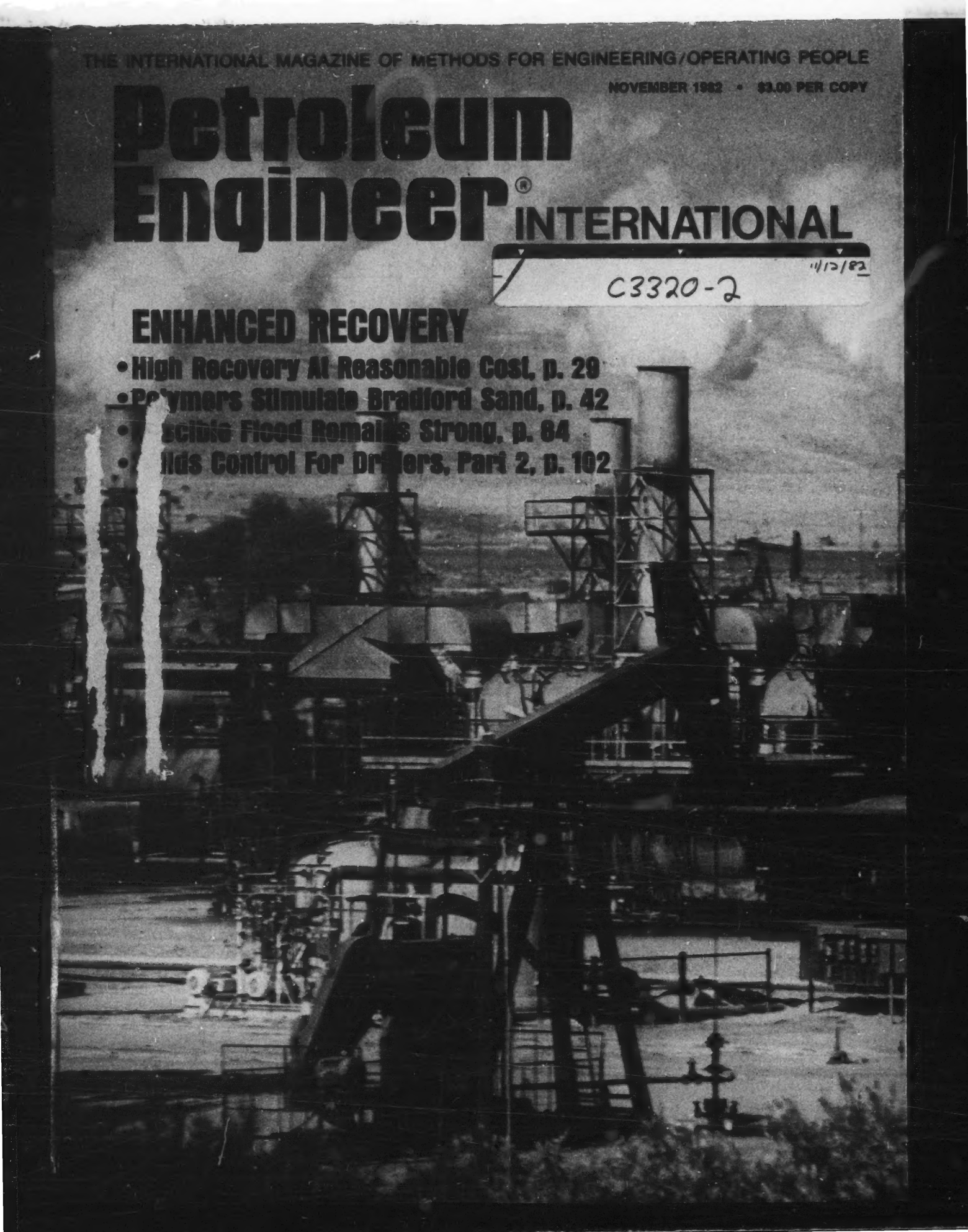
- Polymers Stimulate Bradford Sand, p. 42
- Miscible Flood Remains Strong, p. 84
- Solids Control For Drillers, Part 2, p. 102



Petroleum Engineer® INTERNATIONAL

The international magazine of methods for engineering/operating people

NOVEMBER 1982 NUMBER 13 VOLUME 54

ABOUT THE COVER: Eight 50-million-Btu/hr steam generators are shown at Texaco's San Ardo field in California, with a flue gas recirculation system at left foreground. See page 29 for related story. (Cover photo by Jan R. Golon, Texaco Inc.)

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29 **Engineering Expertise Ups San Ardo Efficiency**
by W. B. Bleakley, Editor. Mature parts of the Aurignac reservoir have given up more than 60% of the original oil in place. Engineers are confident, however, that overall recovery can be raised to 70% or more.

42 **Micellar-Polymer Flood Tested In Bradford Field**
by Wayne R. Hause, Godsey-Earlougher; Gerald W. Haws, Marathon Oil; and Philip S. Ondrusek, Pennzoil Exploration and Production. The micellar slug's efficiency was probably impaired by tightness of the rock.

70 **N_2-Driven LPG Achieves Miscibility At High Temperatures**
by Larry Carlisle, Mike Montes Jr., Scott Reeves, and Paul B. Crawford, Texas A&M University. Miscible displacement can be achieved at temperatures higher than the critical temperature of propane.

84 **Block 31 Miscible Flood Remains Strong**
by W. B. Bleakley, Editor. Larger amounts of miscible gas could be injected into the reservoir by burning the same amount of hydrocarbon gas, and additional benefit could be gained by firing steam boilers.

96 **What's New In Enhanced Recovery**
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NEXT ISSUE: The Offshore Operations Report in the November 15 issue of PETROLEUM ENGINEER INTERNATIONAL will focus on operational innovations and basic research.

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by Michael P. Williams, Amoco Production Co. Can the desander or desilter process 125% or more of the maximum circulation rate anticipated while drilling with mud over a significant depth interval?

116 Shell Pushes Ahead In The Williston Basin

by Steven D. Moore, Drilling Editor. One of the biggest problems continues to be washout of salt sections, even though the drilling mud is super-saturated. Fairly high downhole temperatures lead to undersaturation.

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Stacked Rigs Approach 2,500-Mark

There are more rigs stacked in the U.S. than were drilling only 3 years ago.

Statistics bandied about at last month's meeting of the Independent Petroleum Association of America indicate that 2,419 rigs were idle in mid-August. The average rig count for 1979 was 2,176. And, except for 1980 and 1981, you have to go all the way back to 1957 to find an average rig count higher than the number of today's stacked rigs.

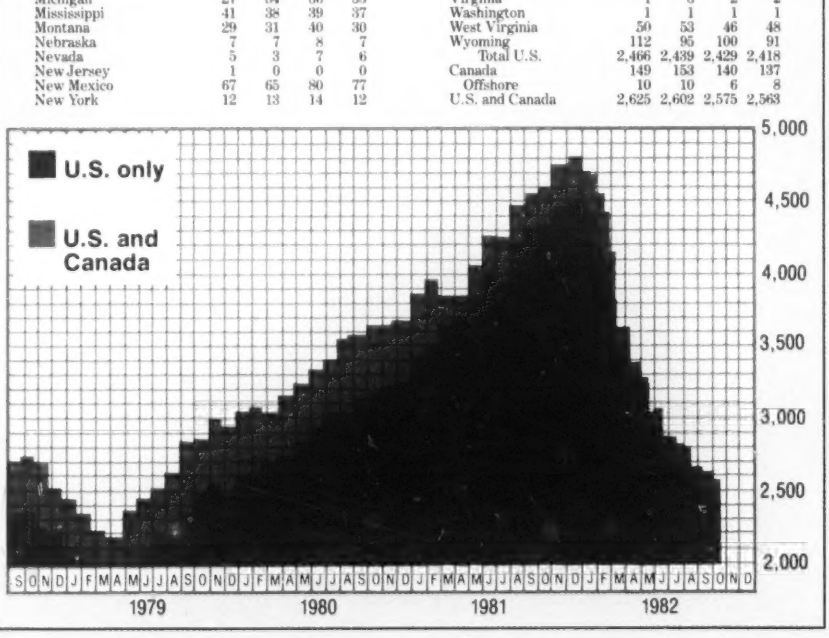
Texas, which began the year with 1,452 active rigs, has seen 647 of them idled as of mid-October. Oklahoma's count is down by 483 so far this year, and Louisiana has seen almost 200 rigs move back to the yards.

This year's average U.S. rig count, as of mid-October, is 3,254. Last year, at the same time, the average stood at 3,738. That is less than 500 rigs higher despite the large number of stacked rigs. The answer, of course, is that a substantial proportion of today's rigs did not even exist during the early months of 1981.

Rotary Rigs Actually Making Hole In United States & Canada

As Reported To International Association Of Drilling Contractors By Hughes Tool Co.

	Sept. 20, 1982	Sept. 27, 1982	Oct. 4, 1982	Oct. 11, 1982
Alabama				
Land	6	6	8	8
Inland Waters	2	2	2	3
Alaska				
Land	14	13	13	14
Offshore	2	1	2	2
Total	16	14	15	16
Arkansas	25	28	26	26
Arizona	1	0	0	0
California				
Land	90	97	92	86
Offshore	24	24	20	21
Total	114	121	112	107
Colorado	51	50	52	54
Florida				
Land	5	5	5	5
Hawaii	1	1	1	1
Illinois	76	72	74	72
Indiana	7	6	8	9
Kansas	117	120	112	123
Kentucky	7	9	8	8
North Louisiana	26	29	31	36
South Louisiana				
Inland Waters	45	47	44	44
Land	84	84	83	74
Offshore	124	131	130	139
Total Louisiana	279	291	283	293
Michigan	27	34	36	35
Mississippi	41	38	39	37
Montana	29	31	40	30
Nebraska	7	7	8	7
Nevada	5	3	7	6
New Jersey	1	0	0	0
New Mexico	67	65	80	77
New York	12	13	14	12
North Dakota	63	60	62	58
Ohio	58	62	64	46
Oklahoma	428	409	380	366
Oregon	1	1	2	2
Pennsylvania	37	35	28	35
Rhode Island				
Offshore	1	1	0	0
Tennessee	2	1	1	0
Texas				
Offshore	73	73	74	72
Texas				
Inland Waters	8	7	7	9
Dist. 1-S. Central Tx.	27	29	33	28
Dist. 2-Middle Tx. Coast	36	32	32	34
Dist. 3-Upper Tx. Coast	100	102	105	114
Dist. 4-Lower Tx. Coast	72	72	73	75
Dist. 5-N.E. Tx.	20	18	14	19
Dist. 6-Far N.E. Tx.	73	68	72	72
Dist. 7B-N. Central Tx.	47	48	43	44
Dist. 7C-W. Central Tx.	49	49	50	56
Dist. 8-Far West Tx.	98	98	96	99
Dist. 8A-West Tx.	67	66	59	65
Dist. 9-North Tx.	69	66	72	72
Dist. 10-Tx. Panhandle	44	43	41	46
Total Texas	783	771	771	805
Utah	33	31	37	35
Virginia	1	3	2	2
Washington	1	1	1	1
West Virginia	50	53	46	48
Wyoming	112	95	100	91
Total U.S.	2,466	2,439	2,429	2,418
Canada	149	153	140	137
Offshore	10	10	6	8
U.S. and Canada	2,625	2,602	2,575	2,563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darko Basin in Beckham County, Oklahoma, was tested from perforations at 24,928-69 ft.

The well, Tipton No. 2-29, flowed after stimulation at a rate of 14.6 MMcfd of natural gas through a 17/64-in. opening, with flowing tubing pressure of 4,884 psi.

International Rig Count Dips In August

The international rig count was down slightly in August, although most regions of the world stood fairly pat. Africa, for example, was a model of consistency during the month, and the Far East actually gained 10 rigs.

Biggest loser was Latin America, which was off 13 rigs – directly traceable to Colombia and Brazil. Europe was off eight rigs, and here, too, the cause is easy to spot – the UK offshore.

Although the August total of 1,460 active Free World rigs is 14 below the July total, it is 14 rigs ahead of the 1,446 rigs counted by Hughes Tool Co. at the end of 1981.

International Rotary Rig Report, prepared by Hughes Tool Co.
(Figures in parentheses indicate how many of each country's rigs are offshore rigs.)

	Aug. 1981	July 1982	Aug. 1982
Africa			
Algeria	80	90	90
Angola	4 (4)	13 (10)	13 (10)
Benin	0	1 (1)	1 (1)
Cameroun	8 (8)	7 (6)	7 (6)
Chad	1	1	1
Gabon	13 (8)	11 (9)	11 (9)
Guinea	0	1 (1)	1 (1)
Ivory Coast	4 (4)	4 (4)	4 (4)
Libya	33 (2)	28 (1)	28 (1)
Morocco	6 (1)	5	5
Niger	5	1	1
Nigeria	20 (5)	30 (13)	30 (13)
Congo	7 (5)	7 (6)	7 (6)
Zaire	1	2 (1)	2 (1)
Senegal	0	1	1
Sierra Leone	0	1 (1)	1 (1)
South Africa	2 (2)	2 (2)	2 (2)
Sudan	3	2	2
Tunisia	11 (3)	11 (3)	11 (3)
	198 (42)	218 (58)	218 (58)
Europe			
Austria	10	8	8
Denmark	2 (2)	2 (2)	2 (2)
France	17 (2)	19	19
Germany	28	31	31
Greece	6 (3)	4 (2)	4 (2)
Holland	19 (9)	23 (15)	23 (15)
Ireland	0	1 (1)	1 (1)
Italy	32 (7)	43 (7)	43 (7)
Norway	12 (12)	12 (12)	12 (12)
Portugal	1	1	1
Spain	9 (1)	11 (5)	11 (5)
Switzerland	1	1	1
United Kingdom	60 (55)	59 (58)	51 (50)
Yugoslavia	22	25	25
	219 (91)	240 (102)	232 (94)
Far East			
Bangladesh	5	7	7
Brunei	7 (6)	8 (6)	8 (6)
Burma	31	33	33
India	44 (7)	51 (11)	51 (11)
Indonesia	86 (27)	82 (33)	94 (33)
Japan	12 (2)	19	19 (1)
Malaysia	11 (11)	12 (12)	12 (12)
Pakistan	14	16	17
Philippines	13 (3)	15 (3)	13 (3)
Taiwan	12 (1)	6	5
Thailand	8 (5)	8 (5)	8 (5)
	243 (62)	257 (70)	267 (71)
Latin America			
Argentina	73 (4)	63 (1)	66
Barbados	1	1	1
Bolivia	12	12	12
Brazil	86 (30)	95 (30)	90 (28)
Chile	8 (4)	7 (3)	7 (3)
Colombia	20	26	17
Ecuador	4	5 (1)	5 (1)
Guatemala	7	3	3
Mexico	220 (20)	194 (23)	194 (23)
Peru	27 (6)	24 (6)	22 (6)
Trinidad	15 (8)	14 (6)	14 (5)
Venezuela	65 (18)	72 (18)	72 (19)
	538 (90)	516 (88)	503 (85)
Middle East			
Abu Dhabi	34 (16)	42 (24)	42 (24)
Bahrain	1	1	1
Dubai	2 (2)	3 (2)	3 (3)
Egypt	27 (16)	39 (25)	39 (25)

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The Model 5420 ACCU-TRAK™ 2 detects drilling variables from almost any rig surveillance or monitoring device. This includes recording and monitoring sources like: strokes-per-minute/revolutions-per-minute "tach generators"; weight indicators; pressure transmitters; line tensionometers; and, electrical torque sensors.

The unit displays any variance of data with an accurate, digital Liquid Crystal Display (LXD) readout. Because the ACCU-TRAK™ 2 is powered by a Lithium "pacemaker" battery pack, there's never any problems with sparks, shock hazards or blown fuses. No rig power is ever required. The enclosed battery pack is guaranteed for five years.

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For more information on the ACCU-TRAK™ 2 call Electro-Flow Controls Inc., (713) 723-6953.

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	Aug. 1981	July 1982	Aug. 1982
Iraq	5	5	5
Kuwait	3	5	5
Oman	10	14 (2)	12 (2)
Qatar	7 (4)	6 (3)	5 (2)
Ras Al Khaimah	1	2 (1)	2 (1)
Saudi Arabia	31 (15)	26 (10)	27 (11)
Sharjah	3 (1)	3	3
Syria	16	15	15
Turkey	26	43	43
Umm Al Qaiwain	1	1	1
	167 (54)	205 (67)	203 (68)
South Pacific			
Australia	23 (4)	36 (9)	35 (8)
Fiji	0	1	1
New Zealand	1 (1)	1	1
	24 (5)	38 (9)	37 (8)
Totals	**1,389 (344)**	**1,474 (394)**	**1,460 (384)**

Lear Tests Gas In Anadarko Basin

Lear Petroleum Corp.'s No. 1-10 Peck well in the Anadarko Basin of western Oklahoma tested 4.6 MMcfd on a 19/64-in. choke with flowing tubing pressure of 7,300 psi.

Production is from the Atoka formation at intervals from 14,276 to 14,284 ft. The well is located in a new, unnamed field in north-central Caddo County.

Howell Strikes Oil Offshore Louisiana

Howell Petroleum Corp.'s Howell Federal No. 1 in Main Pass Block 64 offshore Louisiana tested 805 b/d of oil and 315 Mcfd of natural gas through a 20/64-in. opening at a flowing tubing pressure of 600 psi. The well was perforated at 7,357-75 ft.

Salen To Drill Offshore Portugal

Salen Energy, Salenia of Sweden's Salen group, and Neste, the Finnish national oil company, plan to explore for oil and gas over about 500,000 acres of the northern part of Portugal's continental shelf from the shoreline to 600 ft depth.

The area's geological structure is thought to be related to the shelf offshore Newfoundland, where the Hibernia field was recently discovered.

Amoco Hits Oil In Gulf Gas Field

Amoco Production Co. has completed an oil discovery in an existing gas field at Eugene Island Block 273, about 184 miles south-southwest of New Orleans, in the Gulf of Mexico.

Part of a redevelopment program, the well, OCS-G 0987 B-13, was drilled below the Lower Pleistocene sand into the new oil zone. It flowed 2,760 b/d on a 37/64-in. choke with flowing tubing pressure of 1,416 psi. Drilled to total vertical depth of 8,602 ft, the well was completed in the Upper Pliocene sand between 7,972 and 8,008 ft.

Ratliff Tests Two Development Wells

The Clarkland No. 2 and the Stone No. 3, development wells in Oklahoma County, Oklahoma, have been completed by Ratliff Exploration Co.

The former flowed 641 b/d of oil and 450 Mcfd of gas on a 20/64-in. choke with flowing tubing pressure of 900 psi. Completion was from the Prue sand at 7,486-555 ft.

The Stone No. 3 is a dual completion. From perforations in the Red Fork sand at 7,778-816 ft, it tested 1,080 b/d of oil and 756 Mcfd of gas with a 20/64-in. choke and flowing tubing pressure of 750 psi. From the Prue sand, at 7,560-629 ft, it tested 960 b/d of oil and 672 Mcfd of gas on a 20/64-in. choke with flowing tubing pressure of 800 psi.

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